Why do Osteoporotic Patients fall more often?

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## Facts

- Frequency of falls increases with age. (Jansenberger et al. 2011)
- Number of falls increases due to demographic change.
- Falls are responsible for 40% of admissions to a nursing facility. (AGS 2001)
- 90% of the hip-, shoulder-, forearm-, and pelvic fractures result from falls. (Tinetti 2003)
- **After hip fracture:** (Tinetti 2003)
  - 50% are no longer as mobile as before
  - 18% need support by a nurse
  - 17% die

- Age
- Muscular weakness in the lower extremity
- Disorders of lateral stability
- Disorders of gait and mobility
- Visual loss
- Multi medication (≥ 4 drugs) or the ingestion of certain classes of drugs (neuroleptics, antidepressants, benzodiazepines).
- Disorders of cognition
- Recurrent falls
- Osteoporosis (Pinheiro et al. 2010)
Why osteoporosis?

Cardinal symptoms of osteoporosis patients

- Increased kyphosis / inclination
- Hypomobility of the spine
- Back pain
Hypotheses about Potential Risk Factors

1. The **more pronounced the inclination**, …

2. The **lower the total spine mobility**, …

3. The **higher the spinal pain**, …

   …**the greater the risk of falling** of osteoporosis patients.
### Additional Questions

1. Does the **kyphosis**...
2. Does the **lordosis**...
3. Does the **total score of kyphosis + lordosis + inclination**...
4. Does the **rotation**...
5. Does the **lateral flexion**...
6. Does the **extension-flexion-range**...

... have an influence on the risk of falls in patients with osteoporosis?
Subjects

- Patients with osteoporosis (n = 100)
  - Age ≥ 55 years
  - Bone density: t-value ≤ -2.5
  - no acute fracture
  - no disease that restricts the gait or balance
  - no disturbance of cognition
Statistics

- Linear regression analysis

- Results of the potential risk factors (Hypotheses) were adjusted to those of the known risk factors.

- Main questions:
  - Answer by confirmatory analysis
  - Significance level of $\alpha = 0.05 / 3 = 0.017$ (Bonferroni correction)

- Additional Questions:
  - Answer by exploratory analysis
  - Significance level $p < 0.05$
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Method</th>
</tr>
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<tbody>
<tr>
<td>Level of physical activity</td>
<td>→ Physical activity of the elderly- questionnaire</td>
</tr>
<tr>
<td>Visual loss</td>
<td>→ Eye chart</td>
</tr>
<tr>
<td>Recurrent falls</td>
<td>→ Question to the patient</td>
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<tr>
<td>Multi medication (≥ 4) or Certain medications group</td>
<td>→ Question to the patient</td>
</tr>
<tr>
<td>Muscular weakness in the lower extremity</td>
<td>→ Chair- Rising Test</td>
</tr>
<tr>
<td>Disorder of lateral stability</td>
<td>→ Tandem Stand</td>
</tr>
<tr>
<td>Disturbances of gait and mobility</td>
<td>→ TUG Test</td>
</tr>
<tr>
<td>Pain</td>
<td>→ Visual analogue scale</td>
</tr>
</tbody>
</table>
## Data Collection II – Posture / Movement of the Spine

<table>
<thead>
<tr>
<th>Posture / Movement of the Spine</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion, Extension</td>
<td>→ SpinalMouse®</td>
</tr>
<tr>
<td>Inclination</td>
<td>→ SpinalMouse®</td>
</tr>
<tr>
<td>Kyphosis</td>
<td>→ SpinalMouse®</td>
</tr>
<tr>
<td>Lordosis</td>
<td>→ SpinalMouse®</td>
</tr>
<tr>
<td>Rotation</td>
<td>→ Pluricompas</td>
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<tr>
<td>Lateral Flexion</td>
<td>→ Plurimeter</td>
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</tbody>
</table>
Data Collection III – Risk of Falling

**Tinetti Test:**
- Evaluation of 16 items (balance, walking)
- Maximum 28 points
- <20 points: disturbance of mobility and risk of falling
Results I

- **Inclination has no** statistically significant influence on the risk of falling (Tinetti-Test) of osteoporotic patients ($p = 0.892$)

  Subjects had only 2° inclination (range -7-17) (!)
  High activity level of the patient population (see Results PASE Questionnaire)
Results II

- **Spine pain affects** the risk of falling (Tinetti-Test) with statistical significance ($p = 0.01$).
Results III

- Total spine mobility has a statistically significant influence on the risk of falling (Tinetti-Test) of osteoporotic patients (p = 0.013). Rotation! (p = 0.019)
Take Home Messages

- Spinal mobility and spinal pain has a statistically significant influence on the risk of falls of patients with osteoporosis.

- This should be considered in the implementation of fall prevention programs.